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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/088,738	07/23/2002	Francis Humblot	33808F172	4589
441 7590 07/27/2007 SMITH, GAMBRELL & RUSSELL 1850 M STREET, N.W., SUITE 800 WASHINGTON, DC 20036			EXAMINER SINGH, PREM C	
			ART UNIT 1764	PAPER NUMBER
			MAIL DATE 07/27/2007	DELIVERY MODE PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/088,738	<b>Applicant(s)</b> HUMBLOT ET AL.	
	<b>Examiner</b> Prem C. Singh	<b>Art Unit</b> 1764	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 11 June 2007.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-7 and 9-24 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-7 and 9-24 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Response to Amendment***

1. Amendment to claims 1 and 12, and cancellation of claim 8 is noted.
2. The amendment filed 06/11/2007 is objected to under 35 U.S.C. 132(a) because it introduces new matter into the disclosure. 35 U.S.C. 132(a) states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows:

The Applicant has not cited and the examiner could not find the support in the specifications for the limitation -- "in the absence of tin"-- in Claim 1 (line 7).

Applicant is required to cancel the new matter in the reply to this Office Action.

### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 1-6, 9-14, and 16-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zimmermann et al (US Patent 5,849,176).

7. With respect to claim 1, Zimmermann discloses, "A process for producing thermally cracked products from hydrocarbons while simultaneously reducing the coke deposits on the heat exchange surfaces consists in adding to the feed to be cracked a mixture of volatile organic compounds containing silicon and volatile organic

compounds containing sulfur." (Column 2, lines 27-37). "The temperature used is between 700 to 1000°C when the heat exchange surface is metal inner wall of a tubular reactor. The temperature is 400 to 750°C when the heat exchange surface is the metal surface of a heat exchanger, for example, which is connected downstream to the tubular reactor." (Column 2, lines 57-62). "The compound containing silicon and/or sulfur is preferably selected from the group that consists of dimethyl sulfide, tetramethyl silane, and their mixtures. However, other volatile compounds can also be used." (Column 2, lines 65-67; column 3, lines 1-3). "N-heptane was subjected to pyrolysis under normal pressure in steam as the diluent." (Column 4, lines 47-49). Zimmermann further discloses in Table 2 (Column 8, lines 5-14) the test time from 0.5 hr to 12 hr for treating a surface with tri-methyl-silyl-methyl-mercaptan during pyrolysis of n-heptane in presence of steam.

It is to be noted that the results in Table 2 use a composition simultaneously containing silicon and sulfur both. But the invention adds, "These rates indicate that in place of compounds that simultaneously contain both silicon and sulfur, mixtures of silicon compounds and sulfur compounds also attain the same effect as coke formation inhibitors." (Column 6, lines 52-56).

It is also to be noted that Zimmermann's disclosed compositions do not have tin.

Although Zimmermann uses a temperature range of 700 to 1000°C, it would have been obvious to one skilled in the art at the time the invention was made to modify Zimmermann invention and use a temperature in the range of 300-1100°C to cover a

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wider range and make the process more flexible. One skilled in the art would use any temperature, including in the claimed range, for an effective coke inhibition process.

8. Claims 2-4 have all the limitations of claim 1 and discussed before.

9. With respect to claim 5, Zimmermann discloses, "Figures 1-7 show in respect to pre-activated samples of chrome-nickel steel and samples that display a reduced coking tendency due to special thermal pre-treatment with compounds containing silicon and sulfur, the dependency of coke formation rates on test time during the pyrolysis of n-heptane in nitrogen and in steam as the diluent when known coke formation inhibitors and inhibitors according to the invention are added." (Column 3, lines 54-63).

Although Zimmermann uses nitrogen and steam as diluent separately, it would have been obvious to one skilled in the art at the time the invention was made to modify Zimmermann invention and use a mixture of steam and nitrogen as diluent because the mixture is also expected to be effective for coke inhibition due to the fact that the use of steam and nitrogen individually, is effective. See *In Re Kerkhoven*, 626 F.2d 846, 850, 205 USPQ 1069, 1072 (CCPA 1980).

10. Claim 6 has all the limitations of claim 1 and discussed before.

11. Claims 7 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zimmermann et al (US Patent 5,849,176) in view of Reed et al (US Patent 5,656,150).

With respect to claim 7, Zimmermann does not specifically mention using hexamethyldisiloxane, but the invention does disclose, "Other volatile compounds can also be used, insofar as the object of the present invention is achieved." (Column 3, lines 1-3).

Reed discloses a novel method for treating the radiant tubes of a fired pyrolysis heater with an antifoulant composition for inhibiting coke deposition. Reed uses several silicon compounds including hexamethyldisiloxane (See column 4, lines 32-62).

Since Zimmermann and Reed both inventions disclose coke inhibition on the inner tubes of a cracking reactor by using silicon compounds, it would have been obvious to one skilled in the art at the time the invention was made to modify Zimmermann invention and use hexamethyldisiloxane for coke inhibition as disclosed by Reed because this composition is also effective as other compositions disclosed by Zimmermann. See *In Re Ruff*, 256 F.2d 590, 118 USPQ 340 (CCPA 1958) and *In Re Fout*, 675 F.2d 297, 213 USPQ 532 (CCPA 1982).

12. With respect to claim 9, Zimmermann discloses using di-methyl-di-sulfide (See column 4, lines 3-7).

13. With respect to claim 10, Zimmermann discloses, "In all cases the atomic ratio of silicon and sulfur is between 5:1 to 1:1". (Column 2, lines 48-49).

14. With respect to claim 11, Zimmermann discloses using 20 to 1000 ppm of the additive composition (See column 2, lines 29-31).
15. With respect to claims 12 and 21, Zimmermann discloses using normal pressure (1 atm pressure = 1.013 bar) (See column 4, lines 47-48).
16. With respect to claims 13 and 14, Zimmermann discloses, "On a pre-activated sample of chrome nickel steel dependence of coke formation rate on the test time during n-heptane pyrolysis without and with the addition of 85 ppm dimethyl disulfide is shown in figure 2." (Column 4, lines 3-7).
17. With respect to claim 15, Zimmermann does not disclose using hexamethyldisiloxane.
- Reed discloses using hexamethyldisiloxane as an inhibiting composition being added to the hydrocarbon feed after the pre-treatment (See column 6, lines 5-64).
- As discussed under claim 7, it would have been obvious to one skilled in the art at the time the invention was made to modify Zimmermann invention and use hexamethyldisiloxane as suggested by Reed on a pre-treated sample for coke inhibition because any silicon and/or sulfur compound disclosed by Zimmermann and Reed is expected to be effective.
18. Claims 16-20 and 22-24 have all the limitations of claims 10 and 11, and discussed before.



***Response to Arguments***

19. Applicant's arguments filed 06/11/2007 have been fully considered but they are not persuasive.

20. The Applicant argues that in the paragraph bridging pages 5 and 6 of their response dated December 4, 2006 under a rejection by Zimmermann ' 176, the Reed reference is also being addressed in that paragraph. The statement says that Zimmerman ' 176 is directed to materials that are added to the feed stock to be cracked rather than materials used in the pre-treatment stage as is the case in instant claim 1. The present office action fails to respond to these comments.

The Applicant's argument is not persuasive because Zimmermann ' 176 discloses pre-treatment of the surface of chrome-nickel-steel in Example 9 (See column 6, lines 61-67) and discussed in the Office action dated 02/05/2007 (See page 4 and 5, paragraph 7).

21. The Applicant argues that In the last full paragraph of page 5 of the present specification, the inventors state that surprisingly, it has now been found that an additive composed of a mixture of sulphur compound and of sylyl compound can be used to pre-treat a hydrocarbon cracking tube in steam and thus to significantly reduce the formation of coke which accompanies the hydrocarbon cracking reaction. This is

significant evidence of a clear distinction between the present invention and that of the reference.

The Applicant's argument is not persuasive because Zimmermann ' 176 discloses pre-treatment of chrome-nickel-steel with a trimethyl-silyl-methyl-mercaptan (See column 6, lines 40-57) and adds, "In place of compounds that simultaneously contain both silicon and sulfur, mixtures of silicon compounds and sulfur compounds also attain the same effect as coke formation inhibitors." (Column 6, lines 53-56).

22. The Applicant argues that Zimmermann ' 176 does not teach "pre-treatment, within the context of the invention but only introduction of a material into feed material. Regardless, speculation in the reference about other compounds is not suggestive of applicants' invention.

The Applicant's argument is not persuasive because Zimmermann ' 176 does teach "pre-treatment", as discussed above.

23. The Applicant argues that examiner's reference of example 8 in column 6 of Zimmermann '176 does not support a rejection of the present claims. These generalized statements do not meet the claims which specifically recite individual compounds and which are exemplified in examples 1-6 found pages 10-19 of the present specification. These examples also include comparative examples. This inapposite to examples 6-10

in Zimmermann '176 with example 10 describing comparative examples as well as those according to the Zimmermann invention. A single compound is utilized containing silyl and sulfur. A generic disclosure, such as that relied upon by the examiner in the office action set forth above in the Zimmermann ' 176 reference, does not form the basis to support an obviousness rejection where one skilled in the art would have to choose judiciously from a genus of possible combinations.

The Applicant's argument is not persuasive because Zimmermann '176 discloses figures 5 and 6 showing the effect of using a chrome-nickel-steel alloy pretreated with tri-methyl-silyl-methyl-mercaptan. Figure 5 shows rise in coke formation after 35 hours of operation. Figure 6 shows that coke formation can be inhibited for the same alloy for about 60 hours if tri-methyl-silyl-methyl-mercaptan is added in the pyrolysis feed (See column 5, lines 49-67; column 6, lines 1-15). This clearly indicates that coke formation can be reduced by pre-treating the alloy with tri-methyl-silyl-methyl-mercaptan and also by adding the tri-methyl-silyl-methyl-mercaptan in the feed. Although Zimmermann '176 discloses the use of di-methyl sulfide (See column 2, line 67) and di-methyl disulfide (See column 5, lines 13-14) as additives in the feed, similar to tri-methyl-silyl-methyl-mercaptan, di-methyl sulfide and di-methyl disulfide also can be used to pre-treat the alloy to reduce coking. It is to be noted that the Applicant's claim requires use of a compound of formula  $R^1-Sx-R^2$ , which could be di-methyl sulfide and di-methyl disulfide.

24. The Applicant argues that the present claims specifically recite pre-treatment utilizing multiple distinct compounds in that treatment and specifying the non-silicon containing sulfur compound. Such claims are not met by teachings directed to addition of a compound containing a combination of components to a feed perhaps especially rich in sulfur exemplified by several examples containing a single compound with the multiple components. Teachings drawn to speculative unexemplified silicon and sulfur compounds do not support a rejection under 35 U.S.C. § 103 because they encompass a plethora of compounds for which a person of ordinary skill in the art is not taught how to make and use such generically disclosed compounds in the pre-treatment environment of the present invention.

The Applicant's argument is not persuasive because Zimmermann shows use of tri-methyl-silyl-methyl-mercaptan as an additive in the pyrolysis feed and also as a pre-treating agent for an alloy, as discussed above, showing that both reduce coking. Zimmermann's teaching of using different sulfur and silicon compounds, including dimethyl sulfide and tetra-methyl silane (See column 2, lines 65-67) can not be called as speculative unexemplified silicon and sulfur compounds.

25. The Applicant argues that as pointed out in the response to the previous office action, Reed does not teach or suggest the use of steam with a sulfur compound within the scope of the present claims. Applicants refer the examiner to the last paragraph of page 4 of their response dated December 4, 2006 through line 13 of page 5 of that

paper. Reed does not teach or suggest the use of steam with a particular sulfide compound as recited in claim 1.

The Applicant's argument is not persuasive because Reed has been used for claims 7 and 15 showing the use of hexamethyldisiloxane and not steam.

26. The Applicant argues about Table 2 of the Specifications showing rates of coking of lengths of metal placed in the heat exchanger and states that none of this is taught in the applied prior art. The combination of reference would at the minimum include tin, which is excluded by the present invention.

The Applicant's argument is not persuasive because "exclusion of tin" is not supported by the Applicant's disclosure. Zimmermann '176 (Figures 1-7) shows dependence of coke formation rate on the test time. The Applicant has selected "length" as parameter and Zimmermann '176 has selected "test time" as the parameter. Cited anti-foulants have no tin.

### ***Conclusion***

27. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Prem C. Singh whose telephone number is 571-272-6381. The examiner can normally be reached on MF 7:00 AM-3:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn Caldarola can be reached on 571-272-1444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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